WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Wind Energy

[1]Sachin Kumar, [2]Tarun Singh, [3]hitanshu Khandelwal, [4]Dr. J.P Kesari

[1,2,3,4]Delhi Technological University

ABSTRACT

Wind energy is proven as an alternative to fossil fuels electricity generation. The share of renewable energy gross final consumption in EU-28 reached 16,7% in 2015. Despite the implemented multitude of research on the wind energy projects' environmental impact, the results in some of the study's parts are controversial. The present research meant to identify and classify the environmental impact caused by wind energy use. The analysis is based on analytical review of the science literature and results of field research.

1.INTRODUCTION

The economic development and production in the last century was driven by fossil fuels use. The process of combustion of fossil fuels is followed by high and constantly increasing levels of greenhouse gas emissions [1]. Nowadays when climate change is not only a hypothesis but facing reality the Global world is forced to find and widely implement alternative energy sources. The demand for clean and cheap energy is increasing. The global economy grew at an average of 3.3% per year over the last 30 years. At the same time the global demand of energy rises up to 3.6%. [2,3] The renewable energy sources such as water, wind and solar energy, biomass and geothermal energy have a great potential to be used in a process of greening of the global economy. The European Union, recognizing as a priority and an objective need to oppose climate change and continued deterioration of the environment agreed to follow common EU policy. As an attempt to change the current patterns of production and consumption the EU launched the 2009/28 Directive, regarding renewable energy. The strategy objective is to enforce the renewable energy consumption giving the indicative targets among which is mandatory target 20% for the overall share of energy from renewable sources in overall community energy consumption by 2020 [5]. The share of renewable energy (RE) gross final consumption (GFC) in EU-28 reached 16,7% in 2015 [6]. In the same year for Bulgaria the rate of RE in GFC is 1919,5 ktoe or 18,2% according to the National statistical institute [7]. Based on research of GWEC (Global wind energy counsel) the wind energy has the potential to supply nearly 20 % of the world population by 2030. Other words the current technological level allows to produce 2110GW electricity by wind projects [8]

2. PRINCIPLE

There is an air turbine of large blades attached on the top of a supporting tower of sufficient height. When wind strikes on the turbine blades, the turbine rotates due to the design and alignment of rotor blades. The shaft of the turbine is coupled with an electrical generator. The output of the generator is collected through electric power cables.

3. WORKING

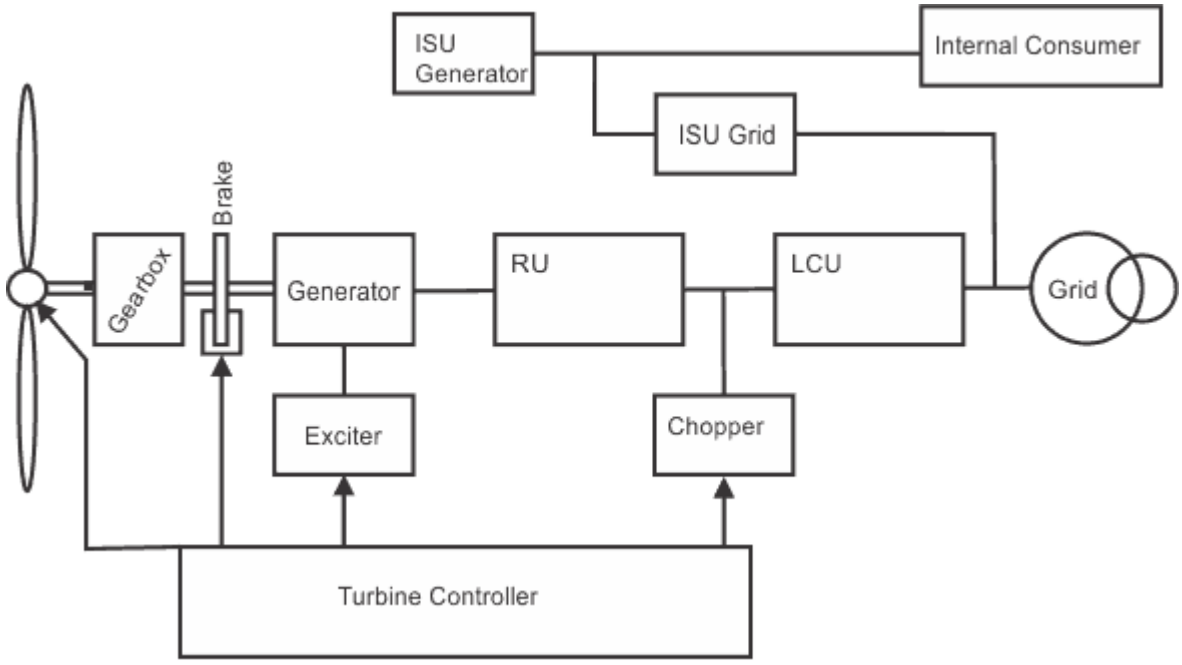
When the wind strikes the rotor blades, blades start rotating. The turbine rotor is connected to a high-speed gearbox. Gearbox transforms the rotor rotation from low speed to high speed. The high-speed shaft from the gearbox is coupled with the rotor of the generator and hence the electrical generator runs at a higher speed. An exciter is needed to give the required excitation to the magnetic coil of the generator field system so that it can generate the required electricity. The generated voltage at output terminals of the alternator is proportional to both the speed and field flux of the alternator. The speed is governed by wind power which is out of control. Hence to maintain uniformity of the output power from the alternator, excitation must be controlled according to the availability of natural wind power. The exciter current is controlled by a turbine controller which senses the wind speed. Then the output voltage of the electrical generator(alternator) is given to a rectifier where the alternator output gets rectified to DC. Then this rectified DC output is given to the line converter unit to convert it into stabilized AC output which is ultimately fed to either the electrical transmission network or transmission grid with the help of a step up transformer. An extra unit is used to give the power to internal auxiliaries of wind turbines (like motor, battery etc.), this is called Internal Supply Unit.

There are two other control mechanisms attached to a modern big wind turbine.

- Controlling the orientation of the turbine blade.
- Controlling the orientation of the turbine face.

The orientation of turbine blades is governed from the base hub of the blades. The blades are attached to the central hub with the help of a rotating arrangement through gears and small electric motor or hydraulic rotary system. The system can be electrically or mechanically controlled depending on its design. The blades are swiveled depending upon the speed of the wind. The technique is called pitch control. It provides the best possible orientation of the turbine blades along the direction of the wind to obtain optimized wind power.

The orientation of the nacelle or the entire body of the turbine can follow the direction of changing wind direction to maximize mechanical energy harvesting from the wind. The direction of the wind along with its speed is sensed by an anemometer (automatic speed measuring devices) with wind vanes attached to the back top of the nacelle. The signal is fed back to an electronic microprocessor-based controlling system which governs the yaw motor which rotates the entire nacelle with gearing arrangement to face the air turbine along the direction of the wind.



Block Diagram

4. Methodology

The identification and understanding of the main qualitative and quantitative features of renewable energy production technologies with respect to environmental quality and the ability of ecosystems to provide ecosystem services is crucial. Many authors during the years worked on this subject like Follestad (2003-2006), Hotker (2006), Winkelman (1989). [13,9,10,15]. Different classifications of environmental impacts of renewable energy power plants are presented by Percival (2003), Leukoma (2002), Howell & DiDonatop (1991)[12,16,15]. The immediate effect of operation of wind energy projects on the environment are tackled, excluding life cycle analysis. The other renewable energy sources lay outside of the frames of current top The present article aims to review and highlight the different aspects of interaction between wind turbine projects and environment. This study is based on an overview of published results of research on environmental impacts of wind power plants and wind energy projects, on - field researches and reports. The scientific literature review of more than fifteen outstanding authors working in the field of renewable energy and environment is Performed

5. WIND ENERGY IN INDIA

Wind power generation capacity in India has significantly increased in recent years. As of 1 July 2022, the total installed wind power capacity was 40.788 GW, the fourth largest installed wind power capacity in the world.[2] Wind power capacity is mainly spread across the Southern, Western and Northern Western regions.

Wind power costs in India are decreasing rapidly.[4] The levelised tariff of wind power reached a record low of ₹2.43 (3.0¢ US) per kWh (without any direct or indirect subsidies) during auctions for wind projects in December 2017.[5][6][7] However, the levelised tariff increased to ₹2.77 (3.5¢ US) per kWh in March 2021.[8] In December 2017, union government announced the applicable guidelines for tariff-based wind power auctions to bring more clarity and minimize the risk to the developers.

6. National Wind Power Potential

The Indian government has installed over 800 wind-monitoring stations all over the country through the National Institute of Wind Energy (NIWE) and issued wind potential maps at 50m, 80m, 100m, and 120m above ground level. The recent assessment indicates a gross wind power potential of 302 GW in the country at 100 meters and 695.50 GW at 120 meters above ground level. The estimated potential is found on the higher side as the present installed capacity is operating below 20% CUF on average against the minimum 30% CUF considered while assessing the wind potential.

7. Wind power by state

There is a growing number of wind energy installations in states across India.

State	**Total Capacity (MW)**
Tamil Nadu	9608.04
Gujarat	8561.82
Maharashtra	5000.33
Karnataka	4938.60
Rajasthan	4326.82
Andhra Pradesh	4096.65
Madhya Pradesh	2519.89
Telangana	128.10
Kerala	62.50
Others	4.30
Total	**39247.05**

A wind farm in rajasthan

Windmills on tirumala hills at Andhra Pradesh

8. RESULT

Some aspects of interaction between wind energy projects and the environment are clearly positive if compared with conventional power plants.

1. Wind energy production has clear advantages if compared with conventional fossil fuels such as coal, petrol and gas. According to Energy Saving Trust Field (2009) the avoided CO2 emissions from 2,5kW electricity from wind power plant is approximately 1-2 ton CO2.

Land use is one of the most exanimated among the negative environmental impact.

Noise Pollution is a major disadvantage of using wind turbines. Noise pollution depends mostly on the wind speed. Noise from a wind turbine can be separated into mechanical noise and aerodynamic noise.

9. Conclusion

The interaction between wind power projects and the environment has many aspects in the field of social development, economic wellbeing and environmental protection. Wind is a relatively clean energy source, avoiding greenhouse gas emissions and water consumption. However, energy generation by wind turbines is not free from negative environmental impacts: land use conflicts, wildlife disturbance, sound noise which is annoying to the vicinity of wind turbine installation projects. Harmful environment effects, rooted in wind power projects technology, in their majority, are preventable.

References

[1]. Guler O. Wind energy status in electrical energy production of Turkey. Renewable and Sustainable Energy Reviews 2009;13:473– 8.

[2]. IEA (International Energy Agency). World energy outlook; 2004.

[3]. IEA (International Energy Agency). World statistic; 2006.

[4]. Toneva D, Stankova T. Renewable energy sources trends in Bulgaria; [5]Eurostat, http://ec.europa.eu/ eurostat/web/ products-datasets/-/t2020_31 [6]Eurostat,http://ec.europa.eu/eurostat/statistics - explained/index.php/File:Share_of_renewables_i n_gross_final_energy_ consumption,_2015_and_ 2020_(%25)_YB17.png

[5]. EU Progress Report, 01.02.2017, http://eurlex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:52017DC0 057&qid= 1488449105433&from=EN